

Follow up agency coordination - CDFG, SHPO and USFWS

Fritts Golden

to:

Michele Dermer

06/15/2010 05:46 PM

Cc:

"Damonica.Pierson@Shell.com"

Show Details

Michele,

The following information details what has transpired by way of coordination. (For brevity, I have omitted greetings/salutations/footers from the email text)

## CDFG

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*I sent biology report to CDFG and replied to some questions. Per an email reply from Brenda Blinn on 5/20/2010 3:35 PM (with you as a cc), they see no problems (but, of course, reserve their right to provide comments on the County CEQA document).*

### CONTACT:

Brenda Blinn - Environmental Scientist

California Department of Fish and Game - Bay Delta Region Habitat Conservation Planning P.O. Box 47 Yountville, California 94599

V: 707 944-5541

C: 707-227-6956

F: 707 944-5563

bblinn@dfg.ca.gov (mailto:bblinn@dfg.ca.gov)

### The email message string with CDFG:

#### GOLDEN:

Attached is a biological resources report prepared by WRA for a project site in Solano County. Briefly, the project requires construction of a drill pad and installation of two wells in the Montezuma Hills area of southern Solano County. The site and vicinity have been evaluated with regard to potential impacts on biological resources and it has been determined that no impacts to these resources are expected.

The wells will be used to injection a small quantity of CO2 into an underground formation approximately 2 miles below the ground surface.

This is a research project to investigate the formation and the behavior of CO2 in the formation. USEPA is responsible for permitting the injection and will evaluate information from the well before and after injection. The only surface disturbance from the project will be construction of a drill pad and penetration of the ground with two wells. The site is used for dry land farming (wheat and grazing) and is in a wind energy farm. The site is plowed every year or two by the farmer. The site is relatively flat and on a ridge and is not near any structures or water bodies.

If, after reviewing the report you have any questions, please contact me by return email or phone

fgolden@aspenerg.com<mailto:fgolden@aspenerg.com> (415) 955-4775 ext 208. or Michele Dermer at USEPA

dermer.michele@epa.gov<mailto:dermer.michele@epa.gov> (415)

972-3417

After reviewing the attached document, please email Michele and myself indicating that you have received and reviewed the report and concur in the conclusion that there is no impact anticipated to biological resources. This will be our confirmation that we have coordinated with your agency with regard to the project.

We are also coordinating with Ryan Olah at USFWS.

#### BLINN

I have reviewed the Biological Assessment for the subject project. Currently, the project description is not detailed enough for DFG to assess potential impacts. We would need to have a detailed description of all construction-related activities, related infrastructure, timeframe, etc. to provide a final determination. My determination and any recommendations would also be subject to supervisory review and approval. At what stage of the NEPA/CEQA process is this project? DFG could more thoroughly review the potential impacts of the proposed project during the public comment period.

A preliminary comment I have is the fact that, according to the B.A., a botanical survey was conducted within the proposed project area on December 18, 2008. Botanical surveys were not floristic in nature, and should be conducted throughout the blooming period for plant species potentially occurring within the proposed project site. DFG-recommended survey and monitoring protocols and guidelines are available at [http://www.dfg.ca.gov/biogeodata/cnndb/pdfs/Protocols\\_for\\_Surveying\\_and\\_Evaluating\\_Impacts.pdf](http://www.dfg.ca.gov/biogeodata/cnndb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf).

#### GOLDEN

Thank you for your quick reply. The project is undergoing CEQA review by Solano County before it can issue a conditional use permit. We expect the Initial Study to be issued by the county in about a month.

Attached is the Initial Study that was provided to the county as part of the conditional use permit application. The project description in the Initial Study is quite complete, and I hope provides you the information you need.

The site has been in dry land agricultural use for many generations.

The site has no trees or shrubs. It is regularly disked by the farmer and sown in dry land grain. After reaping the crop, sheep and cattle are released on the land to graze. These pattern of use has occurred for decades. For these reasons and based on the site inspection, no seasonal plant surveys were indicated.

The attached Map Air images file shows the location of the site. The last two figures in the file are Google images. One shows the site and the farming pattern within which it is situated. The vertical elements on the Google image are tall windmills situated on the property. The last Google image show a larger area around the project site. To the west of the site can be seen a dark area that has been newly disked. The rest of the land has been newly harvested. These images are part of a much larger wind generation facility that is co-located with the farm. The roads on the property are compacted gravel.

Please let me know if there is additional information you may require. Jeff Dreier, at WRA, prepared the biological report that I provided to you earlier. He is on vacation until June 1, but I can help with any information you may require.

BLINN:

Based on the information provided, there appears to be a low likelihood for sensitive plant and wildlife species to occur within the project area. However, DFG may have further comments on the proposed project, and provide recommendations on avoiding or reducing any potential impacts of the project on natural resources during the CEQA review process.

## SHPO

*SHPO has not responded beyond a message saying they coordinate only with Federal agencies. On 5/20 I sent information to them, received a reply, and replied back. I forwarded the string of email messages to you on 5/20 about 3:22 PM. If you send an email or call, remind Bill of the emails and that a report was provided, and inquire if they have any concerns.*

CONTACT:

William E. Soule  
Associate State Archeologist  
Office of Historic Preservation  
Phone: 916-654-4614  
Fax: 916-653-9824  
email: [wsoule@parks.ca.gov](mailto:wsoule@parks.ca.gov)

The message string with SHPO:

GOLDEN

Attached is a cultural resources report prepared by WSA for a project site in Solano County. Briefly, the project requires construction of a drill pad and installation of two wells in the Montezuma Hills area of southern Solano County. The site and vicinity have been evaluated with regard to potential impacts on cultural resources and it has been determined that no impacts to cultural resources are expected.

The wells will be used to injection of a small quantity of CO2 into an underground formation approximately 2 miles below the ground surface. This is a research project to investigate the formation and the behavior of CO2 in the formation. USEPA is responsible for permitting the injection and will evaluate information from the well before and after injection. The only surface disturbance from the project will be construction of a drill pad and penetration of the ground with two wells. The site is used for dry land farming (wheat and grazing) and is in a wind energy farm. The site is plowed every year or two by the farmer. The site is relatively flat and on a ridge and is not near any structures or water bodies.

If, after reviewing the report you have any questions, please contact me by return email or phone [fgolden@aspeneg.com](mailto:fgolden@aspeneg.com) (415) 955-4775 ext 208. or Michele Dermer at USEPA [dermer.michele@epa.gov](mailto:dermer.michele@epa.gov) (415) 972-3417

After reviewing the attached document, please email Michele and myself and Michele indicating that you have received and reviewed the report and concur in the conclusion that there is no impact anticipated to cultural resources. This will be our confirmation that we have coordinated with your agency with regard to the project.

SOULE

The SHPO consults only with federal agencies regarding compliance with Section 106 of the National Historic Preservation Act. After reviewing the initial several pages of your attachment, I cannot identify any federal

involvement (lands, funding, or regulatory). If this is a CEQA action, please contact the lead CEQA agency. Please feel free to contact me if you have any questions.

## USFWS

*I sent the bio report and the Initial Study we prepared for the County to USFWS, but have heard nothing since I provided information. The last message to them was 5/20, 9:46 AM; you were cc on the string of emails. USFWS is always busy, so you will need to follow up with Ryan – reminding him of the information provided, etc.*

### CONTACT:

Ryan Olah  
Coast Bay Branch Chief  
U.S. Fish and Wildlife Service  
Sacramento Fish and Wildlife Office  
2800 Cottage Way  
Sacramento, CA 95825  
(916) 414-6623

### Message string with USFWS:

#### GOLDEN

Susan

I am working on a project in the Montezuma Hills area of Solano County. It is about 2 miles north of the Sacramento River and 2 miles east of Suisun Marsh in upland agricultural land. It sits in the midst of an existing wind electric generation facility. I would like to discuss the project with you briefly to ensure that we have adequately coordinated with Fish and Wildlife. A site survey and records search have been done by WRA. No species of concern were found and no suitable habitat. The project involves about 8 acres of earthwork (pad building) and the drilling of two wells.

Solano County is the local lead agency for environmental review. USEPA is reviewing the project for a permit to construct the wells and inject a small volume of CO2 2 miles underground. This is part of a DOE-funded investigation of Carbon Capture and Storage.

Please telephone me when you can so that I may review the project in more detail.

#### MOORE

I have asked Cay Goude, our Assistant Field Supervisor, to give you a call. She oversees projects in Solano County.

Susan Moore  
Field Supervisor  
Sacramento Fish and Wildlife Office  
Phone: (916) 414-6700  
Fax: (916) 414-6714

#### OLAH

can you send us any information you have on your proposed project? Thanks.

#### GOLDEN

This is a CEQA Initial study we provided to Solano County with a Use Permit application. I will send the Biology report in a separate email following this one. This is similar to a project for which an MND was prepared in Thornton, on DWR property at Grizzly Slough. I believe you reviewed that MND. But, this project is remote from water and in the middle of dry agriculture (wheat, post-reaping grazing).

#### OLAH

This project should probably undergo a Section 7 consultation with the Service. EPA would be the federal agency that would consult with the Service. Let me know if you have additional questions.

#### GOLDEN

Given site conditions and the nature of the project, how 'formal' will a section 7 consultation need to be? Would it be sufficient for EPA to send you an email requesting a consultation, discuss the project on the telephone, and then send an email documenting the results of the discussion? I know that everyone (USFWS and EPA) is very busy and am looking for the best way to facilitate this. For a similar WESTCARB project in Arizona, the USFWS office for that region used this approach. Also, how long would the process take?

#### OLAH

It looks like we may be able to do informal consultation, but we would still need to look at all of the information. Informal consultation usually is not that long of a process, and can usually be completed within 30 days.

**GOLDEN**

I assume the information provided earlier (the CEQA initial study and the Biology report) will be sufficient and is the information to which you refer. If there is anything else you need, please let us know. The material that will provide you the most complete information is the Project Description and the Biology sections of the initial study, and the separate Biology report.

That is all of the communications with CDFG, SHPO and USFWS.

**B.Fritts Golden, AICP**

Aspen Environmental Group

235 Montgomery Street Suite 935 - San Francisco, CA 94104

(415) 955-4775 ext.208 Fax: (415) 955-4776 [FGolden@Aspeneg.com](mailto:FGolden@Aspeneg.com)

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RE: Coordination with agencies for C6 UIC permit  
Fritts Golden  
to:  
Michele Dermer  
06/02/2010 01:12 PM  
Show Details

Follow Up:  
Normal Priority.

Completely understand the feeling of being swamped.  
Attached is the draft memo. We can sort out the final version 'for the file' information later. Maybe the memo  
+ copies of emails?  
See you tomorrow.

Fritts

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**From:** Dermer.Michele@epamail.epa.gov [mailto:Dermer.Michele@epamail.epa.gov]  
**Sent:** Wednesday, June 02, 2010 12:51 PM  
**To:** Fritts Golden  
**Subject:** Re: Coordination with agencies for C6 UIC permit

Hi Fritts,

I appreciate all the coordination you have done with these agencies. Its my action to follow up with these agencies, but I have been immersed in the details of the draft UIC permit. You can either send me your draft memo or wait until you have all the information you need. It is my intent to follow up with the agencies over the next couple of weeks.

Regards,

Michele

From: Fritts Golden <FGolden@aspeneg.com>  
To: Michele Dermer/R9/USEPA/US@EPA  
Date: 06/02/2010 09:05 AM  
Subject: Coordination with agencies for C6 UIC permit

---

Hi Michele,

I have a draft memo to send you regarding coordination with agencies, but have some blanks for SHPO and USFWS:

**CDFG:**

I sent biology report to CDFG and replied to some questions. Per an email reply from Brenda Blinn on 5/20/2010 3:35 PM (with you as a cc), they see no problems (but, of course, reserve their right to provide comments on the County CEQA

document)

**SHPO:**

SHPO has not responded beyond a message saying they coordinate only with Federal agencies. On 5/20 I sent information to them, received a reply, and replied back. I forwarded the string of email messages to you on 5/20 about 3:22 PM.

**Do you want to send an email or is this sufficient?**

If you send an email, just note the 5/20 emails and that a report was provided, and inquire if they have any concerns. Also perhaps mention that the County is preparing a Mitigated Negative Declaration under CEQA. You might get a "stock" reply that enumerates measures that must happen if anything is found. These are standard mitigation measures that are incorporated into MNDs.

William E. Soule  
Associate State Archeologist  
Office of Historic Preservation  
Phone: 916-654-4614  
Fax: 916-653-9824  
email: [wsoule@parks.ca.gov](mailto:wsoule@parks.ca.gov)

**USFWS:**

I sent the bio report and the Initial Study we prepared for the County to USFWS, but have heard nothing since and will contact them again. My experience is that USFWS is terribly busy all of the time so things get backed up. The last message to them was 5/20, 9:46 AM; you were cc on the string of emails.

**How would you like me to follow up?**

Fritts

**B.Fritts Golden, AICP**

Aspen Environmental Group

235 Montgomery Street Suite 935 - San Francisco, CA 94104

(415) 955-4775 ext.208 Fax: (415) 955-4776 [FGolden@Aspeneg.com](mailto:FGolden@Aspeneg.com)

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*Markup Copy*



**SOLANO COUNTY**  
**Department of Resource Management**

675 Texas Street, Suite 5500  
Fairfield, CA 94533  
[www.solanocounty.com](http://www.solanocounty.com)

Telephone No: (707) 784-6765  
Fax: (707) 784-4805

Clifford Covey, Interim Director

May 23, 2010

Michele Dermer  
Environmental Scientist, Underground Injection Control  
U.S. Environmental Protection Agency, Region 9  
75 Hawthorne Street (WTR-9)  
San Francisco, CA 94105-3901

Re: C6 Resources LLC –Draft US EPA UIC Permit

Dear Michele:

We appreciate the opportunity to review and comment on the Administrative Draft UIC Permit.

The proposal is subject to a discretionary Land Use Permit approval by the Solano County Planning Commission; thus, subject to the California Environmental Quality Act. The Planning Division has determined that the project is not Categorically Exempt or Statutorily Exempt; therefore, an Initial Study shall be prepared to determine the impacts, level of significance, and appropriate type of environmental document. We have requested that the applicant prepare a preliminary seismic study and Vulnerability Evaluation Framework in order to assist us in determining the impacts relative to induced seismic activity and groundwater quality. Both items remain outstanding.

The following summarizes our concerns regarding the administrative draft permit:

1. The subject site is in close proximity to the Montezuma Fault pursuant to the attached exhibit prepared by the California Division of Mines and Geology, Fault Evaluation Program, 1983. Given the depth of the wells, the injection activity and the proposal to store compressed carbon dioxide, there is potential for induced seismic activity at the subject site. The draft permit does not address such risks or mitigation to reduce such risks.

*The permit includes the requirement for seismic monitoring but no response plan.*

Building & Safety  
David Cliche  
Building Official

Planning Services  
Mike Yankovich  
Program Manager

Environmental  
Health  
Terry Schmidbauer  
Program Manager

Administrative  
Services  
Su Krishnan  
Office Supervisor

Public Works-  
Engineering  
Paul Wiese  
Engineering Manager

Public Works-  
Operations  
Wayne Spencer  
Operations Manager

2. According to the Vulnerability Evaluation Framework (VEF) published by EPA, a qualitative risk assessment should be prepared in accordance with the VEF guidelines. Has a risk assessment been prepared? If so, please provide us a copy.
3. Groundwater testing described on paragraph 3(a) on page 7 of the permit is not clear. For example: 1<sup>st</sup> paragraph imply only TDS testing of "target injection formation water" but there is no definition of "target injection formation water". It also appears that the sole purpose of groundwater testing is to determine compatibility of the injectate with the injection formation. In addition, monitoring on page 22 appears to monitor only the injection fluids. It does not appear that there are any groundwater testing of the upper aquifers. The subject site is in close proximity to rural residential development namely the community of Collinsville. The upper aquifers are potential drinking water sources, therefore; testing should be accomplished to determine any potential cross contamination or any adverse health effects on the upper aquifers from this project.
4. Casing and Completion Specifications on page 11 cited the cement evaluation and specifications. However, there are no stated construction Quality Assurance requirements. An independent quality assurance contractor should be present during construction and submit reports to Solano County's Department of Resource Management.
5. Mechanical Integrity on page 16 to 21 does not have any requirements for any potential emergency procedure in the event of a loss of operational integrity of the well. Development of an emergency procedure should be developed to increase operational safety.
6. Please include in the EPA UIC permit that the approval of the EPA UIC permit shall be contingent upon approval of Solano County's Land Use Permit. In addition, the project proponent shall comply with the conditions and terms of the Solano County's Use Permit. (Reference No. U-09-13, Assessor's Parcel No. 0090-090-280).

Please advise if you need any further clarification. I may be contacted by email [Nnferrario@solanocounty.com](mailto:Nnferrario@solanocounty.com) or phone (707) 784-3170.

Sincerely,

  
Nedziene Ferrario  
Senior Planner

Enclosure:

California Division of Mines and Geology, Fault Evaluation Map

C: David Albright, US EPA



DMG OPEN-FILE REPORT 83-10

**SUMMARY REPORT:  
FAULT EVALUATION PROGRAM,  
1981-1982 AREA—  
NORTHERN COAST RANGES REGION,  
CALIFORNIA**

**1983**



DMG  
OFR  
83-10  
c.2

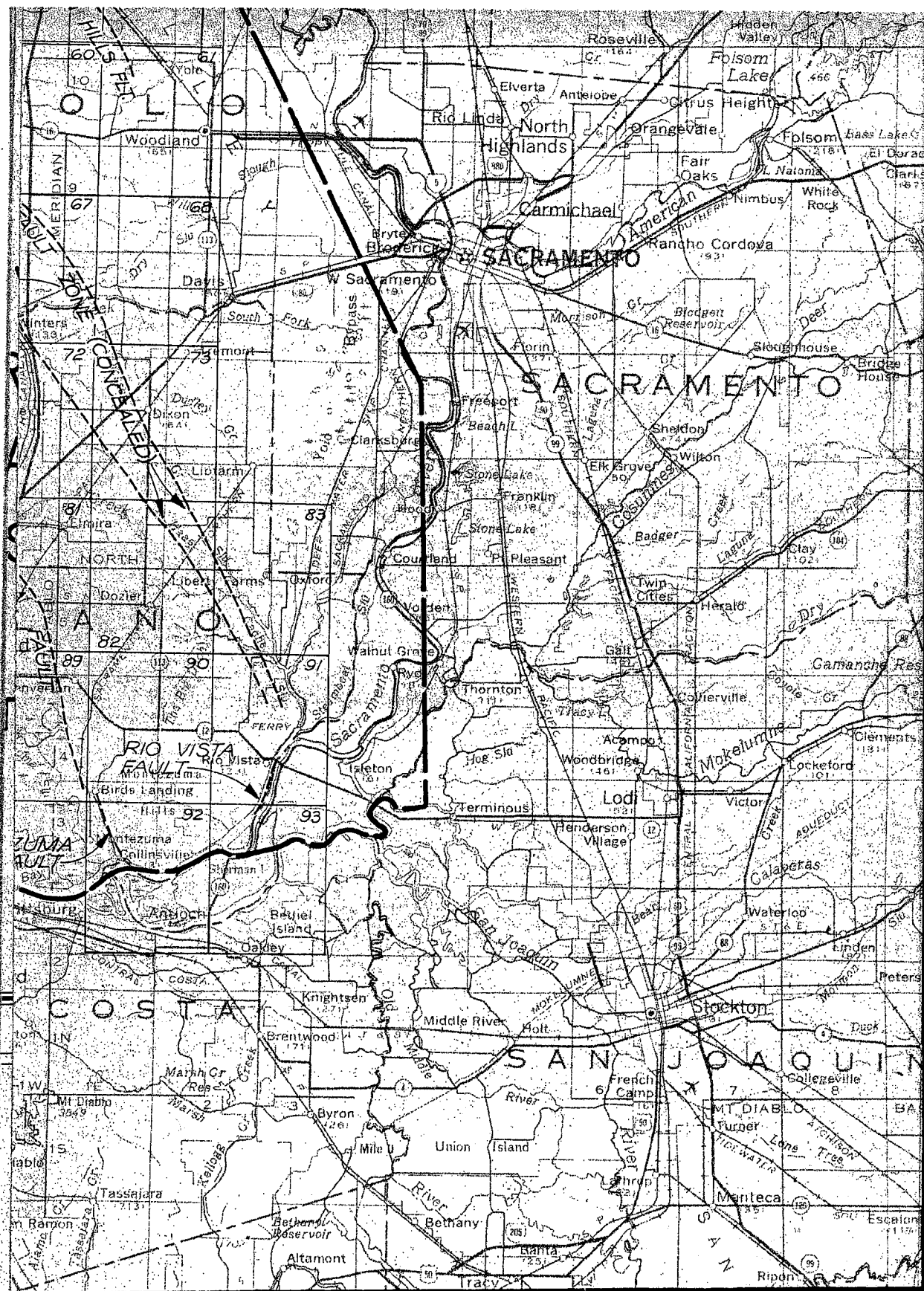
THE RESOURCES AGENCY  
GORDON K. VAN VLECK  
SECRETARY FOR RESOURCES

STATE OF CALIFORNIA  
GEORGE DEUKMEJIAN  
GOVERNOR

DEPARTMENT OF CONSERVATION  
RANDALL M. WARD  
DIRECTOR

Table 1. Summary of faults evaluated during 1981-1982 in the northern Coast Ranges (cont.)

Fault name (alphabetical by counties)	Fault evaluation report (FER) #; investigator	Description of fault (including evidence for recency and inactivity). Is fault well- defined?	Develop- ment pressure	Zoning recommendation; comments.
<u>SOLANO COUNTY (cont.)</u>				
2. Green Valley	126; Bryant	Generally well-defined, right-lateral, strike-slip fault with abundant geomorphic evidence of significant Holocene slip; offset fences indicate historic creep and trenches exposed offset soil of probable Holocene age. Northern projection of fault concealed by landslides. Branches mostly not well-defined and lack Holocene evidence of slip.	mod.	New zone recommended for northern segment; revised zone recommended for southern segment.
3. Midland	133; Bryant	Concealed fault that offsets Oligocene strata, but is not known to offset overlying upper Tertiary units. Considered by some as a source of 1892 Vacaville earthquake which produced ground fissures east of Allendale. Although numerous tonal lineaments and several right-laterally deflected drainages exist in Pleistocene alluvium near Allendale, these features could not be clearly associated with faulting and Holocene features were lacking.	low- mod.	Zoning not recommended.
4. Rio Vista	136; Bryant	Well-defined, linear escarpment in Pleistocene deposits inferred to be a fault, but could be erosional; lacks Holocene evidence of faulting.	low	Zoning not recommended.
5. Vaca-Montezuma Hills zone	136; Bryant	Northwest-trending zone of discontinuous, faults and inferred faults based partly on large-scale geomorphic features (linear scarps and hills, deflected drainages) suggestive of Quaternary faulting; however, some of the features may be erosional. Lacks detailed features indicative of Holocene movement. Most segments poorly defined.	low- mod.	Zoning not recommended.



Fault Evaluations by W.A.Bryant, T.C.Smith and E.W.Hart  
 Drafted by E.Taylor  
 January 1983

**PROJECT MEMORANDUM – C6 RESOURCES LLC**  
**NORTHERN CALIFORNIA CO<sub>2</sub> REDUCTION PROJECT**

**Date:** October 8, 2009  
**To:** Wayne Hamilton  
**From:** Fritts Golden  
**Subject:** Vulnerability Evaluation Framework Review

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## **Background**

In 2008, the U.S. Environmental Protection Agency (EPA) published a technical support document outlining a "Vulnerability Evaluation Framework" (VEF) regarding the geologic sequestration of carbon dioxide (CO<sub>2</sub>).<sup>1</sup> The VEF is to help identify conditions that could increase the potential for adverse impacts to occur from commercial-scale geologic sequestration of carbon dioxide.

As stated in the VEF, attempting to quantify risks of geologic sequestration will become more feasible as information is collected from pilot- and commercial-scale projects. The Northern California CO<sub>2</sub> Reduction Project (NCCRP) is a small-volume injection project with the objective of demonstrating the safety and feasibility of CO<sub>2</sub> storage in saline formations in the northern region of California's Central Valley. As such, many of the components identified in the VEF for commercial-scale projects do not apply or are of marginal applicability to the small-scale NCCRP.

The VEF identifies three components that could increase vulnerability to adverse impacts of a sequestration project. These include

1. Geologic sequestration system and geologic attributes,
2. Spatial area of evaluation, and
3. Potential impact categories and receptors.

Many of the concerns identified in the VEF are addressed for the NCCRP in the Class V UIC Injection Well Application (UIC permit application) submitted to EPA or the Initial Study submitted to Solano County. For that reason, most topics are briefly discussed here. Where germane, reference is made to the UIC permit application and the Initial Study.

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## **1. Geologic Sequestration System and Geologic Attributes**

The VEF characterizes the geologic sequestration system in terms of (a) the confining system, (b) the injection zone, and (c) the CO<sub>2</sub> stream.

**(a) Confining System.** The confining system is the geologic formation, or group of formations, composed of impermeable or less permeable material overlaying the injection zone. The confining system acts as a barrier to the upward flow of fluids. A variety of geologic attributes influence the potential for unanticipated migration and leakage past the confining system, including lateral extent, capillary entry pressure, permeability, travel time, wells and other artificial penetrations, faults/fracture zones/tectonic activity, and geochemical and geomechanical processes. The VEF approach for considering the confining system includes:

- **Establish presence of confining system over necessary lateral extent.**

*Relationship to Project:* As the NCCRP is a small-volume project, the lateral extent of the confining system is significantly greater than the geologic sequestration footprint, which would only extend over a radius of about 350 feet from the point of injection.

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<sup>1</sup> *Vulnerability Evaluation Framework for Geologic Sequestration of Carbon Dioxide*. USEPA. July 10, 2008. EPA430-R-08-009. Available at-- [http://www.epa.gov/climatechange/emissions/downloads/VEF-Technical\\_Document\\_072408.pdf](http://www.epa.gov/climatechange/emissions/downloads/VEF-Technical_Document_072408.pdf)

**ATTACHMENT 2**  
**Vulnerability Evaluation Framework Review for**  
**the Northern California CO2 Reduction Project**

- **Evaluate physical properties of confining system.** The objectives of the project are to appraise and establish the presence of confining shales and permeable injection interval sandstones beneath the Montezuma Hills synclinal structure (Rio Vista basin). There are five potential "pairs" of strata that form confining interval/injection interval combinations beneath the injection site. They are (in stratigraphic order, shallowest to deepest): Nortonville Shale/Domengine Sandstone, Ione-Capay Shale/Hamilton Sandstone, Meganos Shale/Anderson Sandstone, Anderson Shale/Upper Martinez Sandstone, and Martinez Shale/Martinez123 Sandstone (For additional information, see Attachment G Geologic Data on Injection and Confining Zones of the UIC permit application).

*Relationship to Project:* Drilling and testing the wells will confirm the stratigraphy beneath the injection site, including characterizing the geologic material and the thickness of each formation. The capillary entry pressure for the NCCRP will be regulated by the UIC permit issued by EPA. The project may include cased-hole testing to further characterize the injection interval sands (see Section I.2 Cased-Hole Testing Program of the UIC permit application.)

- **Evaluate integrity of the confining system.**

*Relationship to Project:* No recorded wells penetrate the Confining Zone or the Injection Zone of the project within a one-mile radius of the permit area. This eliminates known potential artificial migration pathways to the surface or between formations. One-mile provides a significant buffer area and margin of safety for the project (see Attachment B Maps of Well/Area and Area of Review from the UIC permit application).

Given the relatively small quantity of CO<sub>2</sub> that would be injected and the limitations on capillary entry pressure stipulated in the UIC permit, it is highly unlikely that the CO<sub>2</sub> would migrate or that the project would compromise the integrity of the geology or result in elevated vulnerability.

The seismicity of the San Francisco Bay area is concentrated along transverse faults associated with movement of the Pacific Oceanic plate in a northward direction relative to the North American continental crustal plate. Ninety percent of the seismic events located within the project vicinity are deeper than 8 miles (13 kilometers), well below the formations of interest for the pilot test. Seismic history of the project vicinity and the region are discussed in the UIC permit application.

(b) **Injection zone.** The injection zone is a geologic formation of sufficient areal extent, thickness, porosity, and permeability to accommodate the CO<sub>2</sub> injection volume and injection rate. This zone is characterized by its physical capacity, injectivity, and geochemical and geomechanical processes.

- **Physical capacity.**

*Relationship to Project:* The Central Valley saline formations are estimated to have storage capacity of 140 to 500 gigatonnes of CO<sub>2</sub>. This project would inject up to 6,000 tons of CO<sub>2</sub>. This is a very small volume in relation to the target formation.

- **Injectivity.**

*Relationship to Project:* The injectivity of the geologic formation is unknown at this time. During the 20-day injection process, it is planned that an average of 300 hundred tons of CO<sub>2</sub> per day would be introduced into the formation; however, the actual rate will depend on formation characteristics. The operational factors of the injection will be reviewed and revised as well data and baseline data become available.

- **Geochemical and geomechanical processes.**

*Relationship to Project:* Geochemical modeling for the injection of CO<sub>2</sub> into brine indicates that the pH in the formation brine should not drop below a value of about pH 5.3, due to the buffering

provided by naturally occurring reactive minerals in subsurface formations (see Attachment P Monitoring Program of the UIC permit application.)

**(c) Carbon Dioxide Stream.** When a CO<sub>2</sub> stream is captured at an industrial source, it may have various impurities entrained in it. The effects of these impurities need to be considered.

*Relationship to Project:* The NCCRP would use a commercial or better grade (e.g., food-grade) of CO<sub>2</sub> from a commercial supplier. Because of the quality of the CO<sub>2</sub>, potential adverse impacts from impurities in the CO<sub>2</sub> would not be expected.

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## 2. Spatial Area of Evaluation: Geologic Sequestration Footprint

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The geologic sequestration footprint is based on the size and shape of the CO<sub>2</sub> subsurface plume and associated pressure front associated with the plume.

*Relationship to Project:* The NCCRP is a small-volume project; the edge of the plume is expected to be measure about 350 of feet from the point of injection, which is over 2 miles below the surface.

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## 3. Potential Impact Categories and Receptors.

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The small-volume project is not anticipated to result in adverse impacts (see the NCCRP Initial Study.) However, unanticipated CO<sub>2</sub> migration or leakage, or changes in subsurface pressure could potentially cause adverse impacts to human health and welfare, the atmosphere, ecosystems, groundwater and surface water, or the geosphere. As such mitigations for the unanticipated potential risk, however slight, are incorporated into the project. (*Ibid.*)

- **Potential Human Health and Welfare.** The VEF states that the vulnerability of a population to the release of CO<sub>2</sub> is affected by the population's size and sensitivity to CO<sub>2</sub> and the proximity to and concentration of the release.

*Relationship to Project:* As stated in the Initial Study, the nearest sensitive receptor is one mile away from the injection site. No impacts to any sensitive receptors, including populations covered by Executive Orders, are expected.

The nearest known cultural resource is located 0.75 miles from the project site. The nearest recreational resource is located approximately 2.3 miles from the project site. No impacts to cultural resources or recreational resources are expected. See Section 3.5, Cultural Resources, and Section 3.14, Recreation, of the Initial Study.

The CO injection is not expected to preclude existing land use or subsurface activities at the site. See Section 3.9 Land Use and Planning, of the Initial Study.

- **Potential Atmospheric Impacts.** As the VEF states, releases of CO<sub>2</sub> from the geologic sequestration could reduce the benefits of capturing CO<sub>2</sub>.

*Relationship to Project:* The project is a small-volume project to demonstrate the safety and feasibility of CO<sub>2</sub> storage in saline formations in the northern region of California's Central Valley. Releases of CO<sub>2</sub> are not expected.

- **Potential Ecosystem Impacts.**

*Relationship to Project:* The Initial Study (Section 3.4 Biological Resources) for the project includes an environmental review of impacts to sensitive species and legislatively protected species and concludes that all impacts would be less than significant

- **Potential Groundwater and Surface Water Impacts.**

*Relationship to Project:* The CO<sub>2</sub> injection would occur at nearly 2 miles below the potable water aquifers in the area. Additionally, the potable water aquifers and the injection formations are separated by several impervious shale formations. Any re-injection of produced brine into the storage formations would not affect potable groundwater quality. Appropriate best management practices would be incorporated in the project to minimize any impacts to surface water. See Section 3.8 Hydrology and Water Quality, in the Initial Study. See Attachment D, Maps and Cross Sections of Underground Source of Drinking Water of the UIC permit application.

- **Potential Geosphere Impacts.** As stated in the VEF, changes in subsurface pressure from geologic sequestration have the potential to cause fracturing or reopening of faults and fracture zones.

*Relationship to Project:* Potential impacts related to seismic activities are addressed in the Initial Study (Section 3.6 Geology and Soils).

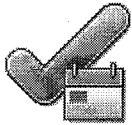
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## **Mitigation and Monitoring**

*Relationship to Project:* Because the volume injected is small, the site is remote from sensitive receptors, and the injection point is over 2 miles deep, the NCCRP results in low vulnerability. Adverse impacts are not expected. Therefore, no mitigation measures would be required.

Monitoring will be a key aspect of the project. Data would be collected on how CO<sub>2</sub> behaves within the formation and on the nature of the geology and its characteristics. Baseline data collection would be performed to evaluate the composition, physical properties, pressure and temperature of native fluids found in the saline formation and near-surface groundwater. Baseline measurements would be compared to data collected during and after CO<sub>2</sub> injection to look for changes in geochemistry, hydrochemistry, and fluid pressures, indicating potential leakage from the target injection formation into overlying formations. Monitoring would be on-going during and after the injection and a post-injection geophysics evaluation is expected to be performed. Attachment P Monitoring Program of the UIC permit application provides additional monitoring details.



**FW: CO2 seismic study issues**

Thu 06/03/2010 11:00 AM - 12:00 PM

Attendance is required for Michele Dermer  
Chair: NNFerrario@SolanoCounty.com  
Location: TBD

Friday  
Da Monica  
Rich Moen  
Dana Dean  
Fritts

→ Colin + Dana - assisting w/ permits

Required: Michele Dermer/R9/USEPA/US, David Albright/R9/USEPA/US

**Description**

Michele & David:

My apologies for the oversight.

Here's the meeting notice for the CO2 meeting. This is still tentative. I'm still awaiting confirmation from Shell Oil attorney (Dana Dean) & who specifically will be attending this meeting, from their side.

Our address is County Government Center, 675 Texas Street, Suite 5500, Fairfield, CA 94533

From: Ferrario, Nedzlene N.  
Sent: Friday, May 21, 2010 3:29 PM  
To: Ferrario, Nedzlene N.; Leland, James H.; Kaltreider, Misty C.; Chan, Victor M.; Laughlin, James W.; CAC Public Works - I 5004  
Subject: CO2 seismic study issues  
When: Thursday, June 03, 2010 11:00 AM-12:00 PM (GMT-08:00) Pacific Time (US & Canada).  
Where: TBD

Discuss County's requirement for a preliminary seismic study and risk assessment with applicant.

Awaiting confirmation from Dana Dean.

to be provided  
to County

VEF Memo. Oct. 8

**Personal Notes**

Shell attendees  
Phone for David

- Da Monica to present
- Rich Moen - subsurface / seismic from shell injection monitoring
- Liz Burton - Berkeley class - induced seismicity USGS Solano Cty. Montezuma fault.
- Seismic study
- Dana Dean - local council
- Fritts Golden - Aspen - vulnerability

CO2 Injection Risk Assessment

Chan, Victor M.

to:

Bruce Kobelski

01/22/2010 12:43 PM

Cc:

Adam Freedman, David Albright, Suzanne Kelly, "Ferrario, Nedzlene N.", "Leland, James H.", "Kaltreider, Misty C.", "Bell, Jeffery", "Schram, Stanley J."

Show Details

History: This message has been forwarded.

Bruce

I work with Ned Ferrario at Solano County and so I am glad you are working with the development of a quantitative risk assessment for the CO2 injection industry.

Solano County Planning Division and Solano County Environmental Health Division are developing strategies to deal with risks such mandating a seismic study to address the potential of induced seismic activity.

Hopefully you can provide more assistance.

One risk is terrorism because I completed a tour in Afghanistan with the US Army Corps of Engineers in 2006.

I was told by Shell Oil that the anti-blowback protection is designed into the well's "injection tree" as check valve branches which are located above the well. However, if a terrorist were to drive a truck and shear off the injection tree he would take out these check valves. This may release all of the contained underground CO2 all at once and potentially cause wide spread asphyxiation.

While a terrorist act is unlikely in Solano County, I have an uneasy feeling that this industry is moving faster than the regulatory agencies can develop all of the rules for risk assessment. The engineering solution is to install a "protected check valve" or "install protective infrastructure around the well".

However, I have yet to see these design features as regulatory requirements. Therefore, I see this as a vulnerability that has not been addressed. When this project is presented at a local public meeting in Solano County, I need a good answer if this specific subject comes up.

My question: Has the US EPA addressed this specific risk?

**Victor M Chan, PE, BCEE**

**Solano County Civil / Environmental Engineer**

**Board Certified Environmental Engineer [www.aace.net](http://www.aace.net)**

**707-784-3177**

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**Victor M Chan, PE, BCEE**  
**Solano County Civil / Environmental Engineer**  
**Board Certified Environmental Engineer [www.aaee.net](http://www.aaee.net)**  
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RE: Discussion of Solano County's Comments on the Draft UIC Permit  
Ferrario, Nedzlene N.  
to:  
Michele Dermer  
06/04/2010 02:50 PM  
Show Details

Call us at Personal Privacy Ex. (b)(6)

Let me know which number to call you, just in case we miss each other

Have a super weekend!

Best,

Ned

---

**From:** Dermer.Michele@epamail.epa.gov [mailto:Dermer.Michele@epamail.epa.gov]  
**Sent:** Friday, June 04, 2010 2:35 PM  
**To:** Ferrario, Nedzlene N.  
**Cc:** Albright.David@epamail.epa.gov  
**Subject:** RE: Discussion of Solano County's Comments on the Draft UIC Permit

Hi Ned,

I just booked next Friday June 11 at 9-10 for a teleconference. Please let me know what number to reach you at your convenience.

Regards, Michele

From: "Ferrario, Nedzlene N." <NNFerrario@SolanoCounty.com>  
To: Michele Dermer/R9/USEPA/US@EPA  
Cc: David Albright/R9/USEPA/US@EPA  
Date: 06/04/2010 02:10 PM  
Subject: RE: Discussion of Solano County's Comments on the Draft UIC Permit

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Hi Michele,

Next Friday works for us. Any time, just name it and I'll schedule it with the rest of our team as well.

Yesterday's meeting went well.

Ned

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**From:** Dermer.Michele@epamail.epa.gov [mailto:Dermer.Michele@epamail.epa.gov]  
**Sent:** Friday, June 04, 2010 2:05 PM  
**To:** Ferrario, Nedzlene N.  
**Cc:** Albright.David@epamail.epa.gov  
**Subject:** Discussion of Solano County's Comments on the Draft UIC Permit

Hi Ned,

Would you have some time next Wednesday or Friday to talk about your comments on the draft UIC permit?  
David and I would like to have a teleconference - would you let me know if that would be possible.

Thanks, Michele

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